MEMS Reconfigurable Radios: System Development and Entry Costs in Wireless Phones

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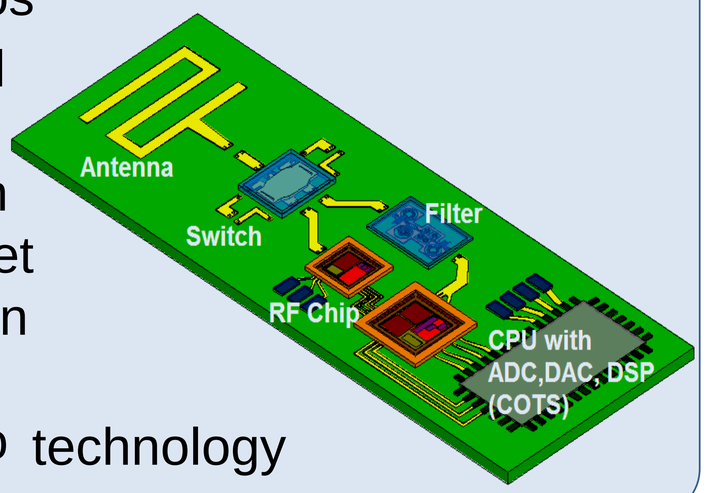
Abstract: Wireless providers need to acquire multiple licenses to provide nationwide services. The rules for current spectrum auctions do not make it trivial to assemble a national footprint. To ease entry costs, the needed technology is multi-standard reconfigurable radios. Existing solutions for multi-standard radios are not scalable. This project addresses these issues by 1) developing reconfigurable radio components; 2) use prices from spectrum auctions and transfers of licenses between carriers to learn how the current portfolios of spectrum licenses contribute to carrier profits. Using these estimates explore how reconfigurable multi-standard radios may change the costs of entering the wireless market with an adequate regional and national footprint.

Goal: Acquiring nation-wide broadband access for a new wireless carrier is costly. This project investigates one set of innovations to ***make national-scale entry less costly by***:

1) Developing micromachined hardware components and new flexible wireless Tx/Rx integrated circuit schemes to enable fully reconfigurable radios
2) Producing empirical estimates and interpreting them in the context of market entry costs based on the proposed reconfigurable radio technology

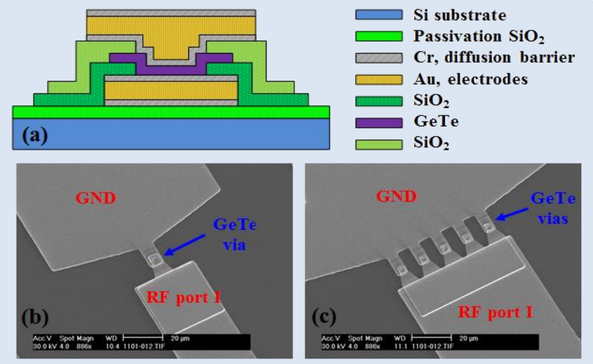


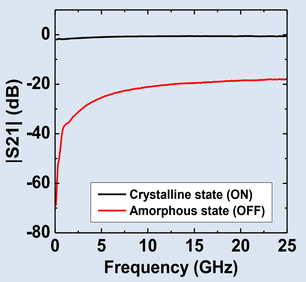
Potential Payoff:

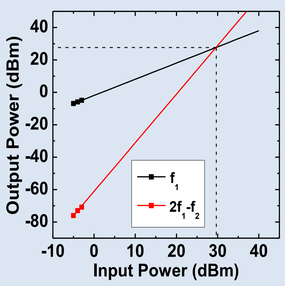
1) Enabling nationwide broadband access to the radio spectrum at lower costs and increased competition between wireless service providers
2) Transformative impacts on the national economy
3) Educating and motivating students

Two approaches are pursued to implement switches

1) Phase change switches for tunable filters: fast switching speed, low loss, and high linearity.
2) MEMS switches for Tx/Rx switch: high power, low loss, hard contact for high reliability







The feasibility of multi-band, multi-standard radio is tested using a tunable MEMS filter (shown on the top right) and a broadband wakeup receiver. When there is no front-end filter, radio can be saturated by strong interferences at any frequency→ high SIR value is necessary to achieve the target BER. With the filter, interference signal out of the pass-band does not affect the target signal in the pass-band. This leads to smaller SIR level.